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3D-Printed Habitat Challenge

Objective

NASA's 3D-Printed Habitat Challenge was a Centennial Challenges Program competition designed to advance additive construction technology needed to create sustainable housing solutions for Earth, the Moon, Mars and beyond. On Earth, these capabilities could be used to construct housing wherever affordable housing is needed and access to conventional building materials and skills are limited. Local indigenous materials (dirt, clay, sand, etc.) could be combined with readily available recyclable materials and used to construct semi-permanent shelters against environmental elements for human habitation. The challenge began in 2015 and was completed in May 2019.

Prize Purse

The total available prize purse for all phases of this challenge was approximately $3 million, provided by the NASA Centennial Challenges Program. Throughout the competition, 60 teams participated, and NASA awarded more than $2 million in prize money.

Description

The 3D-Printed Habitat Challenge was conducted in three phases. Phase 1 of the Challenge, a design competition, was completed in 2015. Teams developed innovative habitat architectural concepts that take advantage of the unique capabilities that 3D printing offers. Two teams qualified to win $40,000 of a $50,000 prize purse.

Phase 2, the Structural Member Competition, focused on the material technologies needed to manufacture structural components from a combination of indigenous materials and recyclables, or indigenous materials alone. Teams qualified to win $701,024 of a $1.1 million available prize purse. Phase 2 was completed in August 2017.

Phase 3, the On-Site Habitat Competition, focused on the fabrication of scaled habitat designs and systems that could use indigenous materials combined with or without recyclable material.

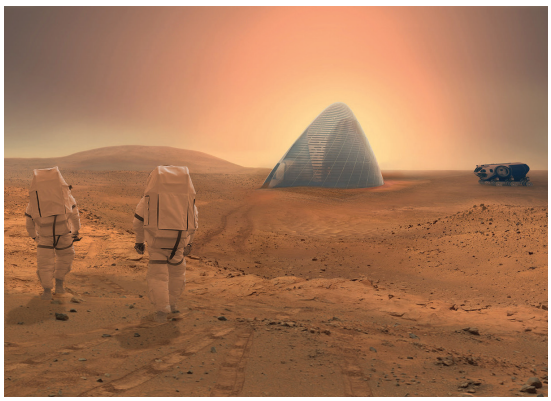

Photo: SEArch/Clouds Architecture Office

Team Space Exploration Architecture (SEArch) and Clouds Architecture Office of New York, New York, designed the above concept, called "Mars Ice House," for the 3D-Printed Habitat Challenge Design Competition. The team won first place in Phase 1 and was awarded $25,000.

The phase was completed in May 2019 with two teams awarded a total of $700,000 in a head-to-head competition at the Edwards Demonstration & Learning Center, a facility of challenge sponsor Caterpillar Inc., in Edwards, Illinois.

The challenge was conducted through a partnership of NASA and Bradley University in Peoria, Illinois. Bradley University also partnered with sponsors Caterpillar Inc. of Peoria, Bechtel and Brick & Mortar Ventures, both of San Francisco, to run the competition. NASA's Marshall Space Flight Center in Huntsville, Alabama, manages the Centennial Challenges program for the Space Technology Mission Directorate in Washington.

Photo: NASA/Joel Kowsky

A team from Pennsylvania State University places weight on a 3D-printed dome structure to test its strength at the Phase 2: Level 3 competition of NASA's 3D-Printed Habitat Challenge. The team won second place.

Photo: Team SEArch+/Apis Cor

Team SEArch+/Apis Cor won first place in the Phase 3: Level 4 software modeling stage of NASA's 3D-Printed Habitat Challenge. The unique shape of their habitat allows for continuous reinforcement of the structure. Light enters through trough-shaped ports on the sides and top.

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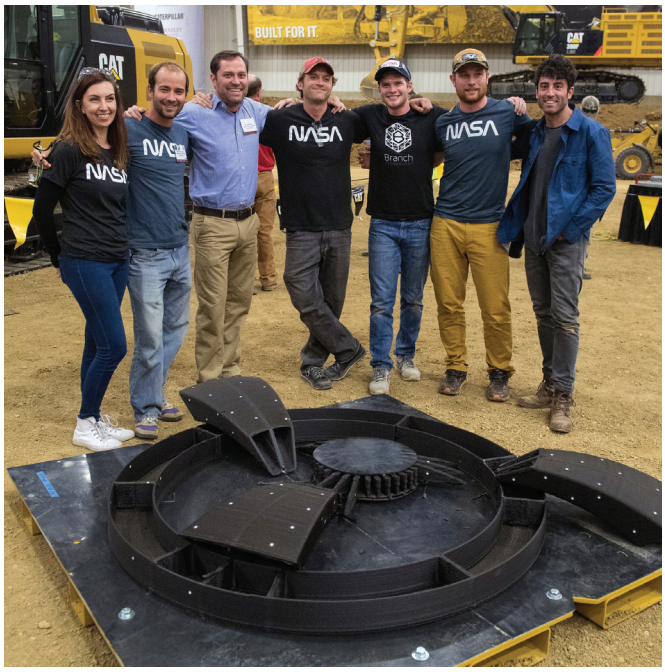
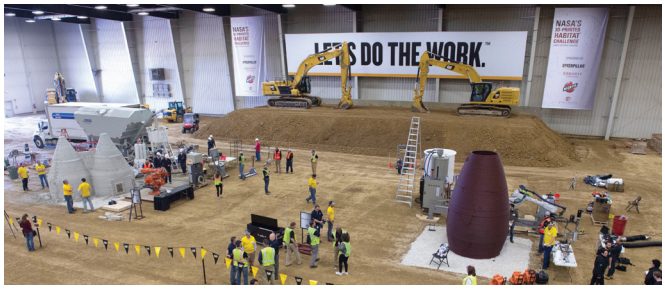


Photo: NASA/Joel Kowsky

A 3D-printed dome structure printed by team Foster + Partners | Branch Technology won first place in Phase 2: Level 3 of NASA's 3D-Printed Habitat Challenge. The dome was crush-tested to failure at the competition.

For more information on the 3D-Printed Habitat Challenge, visit: **www.nasa.gov/3DPHab**.

For information on the Centennial Challenges program, visit: **www.nasa.gov/winit**.



The winning habitat designs were produced in 1/3-scale during the Phase 3, Level 5 head-to-head competition in Edwards, Illinois. First place was awarded to AI SpaceFactory, right, and second place was awarded to Pennsylvania State University, left.

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